IN THE CLAIMS

1. (Currently Amended) A method of determining the residual stress of a material, the method comprising:

marking the material with at least two sets of gage marks, said sets of gage marks each comprising a first mark and a second mark,

measuring a first distance between said first mark and said second mark of each of said sets of gage marks,

stress relieving the material,

measuring a second distance between said first mark and said second mark of each of sets of gage marks, and

calculating the difference between the first distance and the second distance, and thereby determining the amount of elastic residual strain in the material.

2. (Original) The method of Claim 1, wherein the marking is done by a device, which is selected from the group consisting of an electromechanical device, a mechanical device, an electrical device, a chemical device, or combinations thereof.

3. (Original) The method of Claim 1, wherein the marking is done by a micro-hardness-testing machine.

4. (Original) The method of Claim 1, wherein the marking is done by a device powered by human, electrical, steam, or hydraulic power.

5. (Original) The method of Claim 1, wherein the measuring of the first distance and the measuring of the second distance is done by a vision system that can detect the relative position of the one or more sets of gage marks.

6. (Original) The method of Claim 1, wherein the measuring of the first distance and the measuring of the second distance is done by a system employing at least one sensor capable of recognizing said gage marks, said sensor being selected from the group consisting of mechanical, infrared, optical, acoustic, or combinations thereof.

7. (Original) The method of Claim 1, wherein the marking of material is done such that said sets of gage marks are in different orientations from each other.

8. (Original) The method of Claim 1, wherein the marking of material is done such that said sets of gage marks are lines which are parallel to each other.

9. (Original) The method of Claim 1, wherein the marking of material is done such that said sets of gage marks are made at right angles to each other.

10. (Original) The method of Claim 1, wherein the calculating step for determining the amount of elastic residual strain is accomplished with the aid of a computer system.

11. (Original) The method of Claim 10, wherein the computer system further aids in the determination of whether the strain is tensile or compressive by using the relative position of the first and second sets of gage marks.

12. (Original) The method of Claim 10, the computer system uses Young's Modulus, Poisson's Ratio, and the measured strains the amount of residual stress that was induced by the machining operation is thus derived.

13. (Original) The method of Claim 1, wherein the surface of said material has undergone machining, mechanical, or thermal processing.

14. (Original) The method of Claim 1, wherein said measuring at least one of said first distance and said second distance comprises using a traveling microscope.

15. (Original) The method of Claim 1, wherein the marking is done using a vernier height gage is used to mark the material.

16. (Original) The method of Claim 1, wherein marking the material comprises using block gages to give an accurate gage length.

17. (Original) The method of Claim 16, wherein the block gages are used for measuring the first distance to allow for quick and accurate movement of the test piece through the gage length.

18. (Original) The method of Claim 16, wherein the block gages are used for measuring the second distance to allow for quick and accurate movement of the test piece through the gage length.

19. (Original) The method of Claim 1, wherein the calculating includes the use of Young's Modulus, Poisson's Ratio, and the measured strains the amount of residual stress that was induced by the machining operation is thus derived.

20. (Original) The method of Claim 1, wherein the material is selected from the group consisting of constructional and tool steels, stainless steels, titanium, aluminum, copper, nickel and zinc based alloys, nonferrous metals, machinable metals, castable metals, weldable metals, or combinations thereof.

21. (Currently Amended) A method of determining the residual stress of a material, the method comprising:

marking the material with at least one set of gage marks, said at least one set of gage marks comprising a first mark and a second mark for each of said at least one set of gage marks,

measuring a first distance between said first mark and said second mark of each of said at

least one set of ~~the~~ gage marks,

stress relieving the material,

measuring a second distance between said first mark and said second mark of each of said at least one set of ~~the~~ gage marks, and

calculating the difference between the first distance and the second distance, and thereby determining the amount of elastic residual strain in the material.

22. (Currently Amended) A system that can be used to determine the residual stress of a material, the system comprising:

a marking device for marking the material with at least one set of gage marks, each of said at least one set of gage marks comprising a first mark and a second mark,

a measuring device for measuring a first distance between said first mark and said second mark of each of said at least one set of ~~the~~ gage marks,

a device for stress releasing the material,

a second measuring device for measuring a second distance between said first mark and said second mark of each of said at least one set of ~~the~~ gage marks,

a calculating device for calculating the difference between the first distance and the second distance, and thereby determining the amount of elastic residual strain in the material.

23. (Original) The system of Claim 22, wherein the marking device is selected from the group consisting of an electromechanical device, a mechanical device, an electrical device, a chemical device, or combinations thereof.

24. (Original) The system of Claim 22, wherein the marking device is a micro-hardness-testing machine.

25. (Original) The system of Claim 22, wherein the marking device is powered by human, electrical, steam, or hydraulic power.

26. (Original) The system of Claim 22, wherein the measuring device is a vision system that can detect the relative position of the one or more sets of gage marks.

27. (Original) The system of Claim 22, wherein the measuring device is a system employing at least one sensor capable of recognizing said gage marks, said sensor being selected from the group consisting of mechanical, infrared, optical, acoustic, or combinations thereof.

28. (Original) The system of Claim 22, wherein the marking device is capable of making the gage marks in different orientations from each other.

29. (Original) The system of Claim 22, wherein the marking device is capable of marking the gage marks as lines which are parallel to each other.

30. (Original) The system of Claim 22, wherein the marking device is capable of marking the gage marks at right angles to each other.

31. (Original) The system of Claim 22, wherein the calculating device comprises a computer system.

32. (Original) The system of Claim 31, wherein the computer system is capable of also determining whether the strain is tensile or compressive by using the relative position of the first and second gage marks.

33. (Original) The system of Claim 31, wherein the computer system is capable of using Young's Modulus, Poisson's Ratio, and the measured strains the amount of residual stress that was induced by the machining operation is thus derived.

34. (Original) The system of Claim 22, wherein the surface of said material has

undergone machining, mechanical, or thermal processing.

35. (Original) The system of Claim 22, wherein said measuring device used for measuring the first distance, the second distance, or both comprises a traveling microscope.

36. (Original) The system of Claim 22, wherein the marking device is a vernier height gage.

37. (Original) The system of Claim 22, wherein the marking device comprises block gages to give an accurate gage length.

38. (Original) The system of Claim 37, wherein the block gages are used for measuring the first distance to allow for quick and accurate movement of the test piece through the gage length.

39. (Original) The system of Claim 37, wherein the block gages are used for measuring the second distance to allow for quick and accurate movement of the test piece through the gage length.

40. (Original) The system of Claim 22, wherein the calculating device comprises the use of Young's Modulus, Poisson's Rule, and the measured strains the amount of residual stress that was induced by the machining operation is thus derived.

41. (Original) The system of Claim 22, wherein the material is selected from the group consisting of constructional and tool steels, stainless steels, titanium, aluminum, copper, nickel and zinc based alloys, nonferrous metals, machinable metals, castable metals, weldable metals, or combinations thereof.

42. (Currently Amended) A system that can be used to determine the residual stress of a material, the system comprising:

a means for marking the material with one or more sets of gage marks or lines, said one or more sets of gage marks or lines comprising a first mark or line and a second mark or line for each of said one or more sets of gage marks or lines,

a means for measuring the first distance between said first mark or line and said second mark or line of each of said one or more sets of ~~the~~ gage marks or lines,

a means for stress relieving the material,

a means for measuring a second distance between said first mark or line and said second mark or line of each of said one or more sets of ~~the~~ gage marks or lines, and

a means for calculating the difference between the first distance and the second distance, and thereby determining the amount of elastic residual strain in the material.

43. (Original) The system of Claim 42, wherein the means for marking is selected from the group consisting of an electromechanical device, a mechanical device, an electrical device, a chemical device, or combinations thereof.

44. (Original) The system of Claim 42, wherein the means for marking is a micro-hardness-testing machine.

45. (Original) The system of Claim 42, wherein the means for marking is powered by human, electrical, steam, or hydraulic power.

46. (Original) The system of Claim 42, wherein the means for measuring is a vision system that can detect the relative position of the one or more sets of gage marks.

47. (Original) The system of Claim 42, wherein the means for measuring is a system employing at least one sensor capable of recognizing said gage marks, said sensor being selected from the group consisting of mechanical, infrared, optical, acoustic, or combinations thereof.

48. (Original) The system of Claim 42, wherein the means for marking is capable of making the gage marks in different orientations from each other.

49. (Original) The system of Claim 42, wherein the means for marking is capable of marking the gage marks as lines which are parallel to each other.

50. (Original) The system of Claim 42, wherein the means for marking is capable of marking the gage marks at right angles to each other.

51. (Original) The system of Claim 42, wherein the means for calculating comprises a computer system.

52. (Original) The system of Claim 51, wherein the computer system is capable of also determining whether the strain is tensile or compressive by using the relative position of the first and second gage marks.

53. (Original) The system of Claim 51, wherein the computer system is capable of using Young's Modulus, Poisson's Rule, and the measured strains the amount of residual stress that was induced by the machining operation is thus derived.

54. (Original) The system of Claim 42, wherein the surface of said material has undergone machining, mechanical, or thermal processing.

55. (Original) The system of Claim 42, wherein the means for measuring used for measuring the first distance, the second distance, or both comprises a traveling microscope.

56. (Original) The system of Claim 42, wherein the means for marking is a vernier height gage.

57. (Original) The system of Claim 42, wherein the means for marking comprises block gages to give an accurate gage length.

58. (Original) The system of Claim 57, wherein the block gages are used for measuring the first distance to allow for quick and accurate movement of the test piece through the gage length.

59. (Original) The system of Claim 57, wherein the block gages are used for measuring the second distance to allow for quick and accurate movement of the test piece through the gage length.

60. (Original) The system of Claim 42, wherein the means for calculating comprises the use of Young's Modulus, Poisson's Rule, and the measured strains the amount of residual stress that was induced by the machining operation is thus derived.

61. (Original) The system of Claim 42, wherein the material is selected from the group consisting of constructional and tool steels, stainless steels, titanium, aluminum, copper, nickel and zinc based alloys, nonferrous metals, machinable metals, castable metals, weldable metals, or combinations thereof.

62. (Currently Amended) A method of determining the residual stress of a material and whether the residual stress is tensile or compressive in nature, the method comprising:

marking the material with a first gage mark and a second gage mark [at least two gage marks],

measuring a first distance between said first gage mark and said second gage mark [the gage marks],

stress relieving the material,

measuring a second distance between said first gage mark and said second gage mark [the gage marks], and

calculating the difference between the first distance and the second distance, and thereby determining the amount of elastic residual strain in the material and whether the residual strain is tensile or compressive in nature.

63. (Original) A method of modeling of a component residual stress from production of raw billet through to finished machined component, the method comprising:

determining the residual stress of a material a first time, according to the method of Claim 1 and making a record of the amount of elastic residual strain in the said material,

repeating the method of Claim 1 on other materials of identical nature and machine treatment history as the material of said first time and making a record of the amount of elastic residual strain for the other material for each repeated method of Claim 1, so as to compile a library of results for said repeated methods of Claim 1, and

analyzing said library of results, whereby said analysis provides an expected outcome or profile of elastic residual strain for materials identical in nature and machine treatment history,

repeating the above process so as to compile a data base of different materials and different machine histories of those materials such that said expected outcome can be used as a predictive model for determining the residual stress of a material from raw billet through to finished machined component.